

# SOUTH DAKOTA STATEWIDE FISHERIES SURVEY

2102-F-21-R-43

**Name:** Lake Sinai

**County:** Brookings

**Legal Description:** T109N- R52W-Sec 3-4, 8-10

**Location from nearest town:** 1 mile west, 1½ miles north of Sinai, SD

**Dates of present survey:** June 28-30, 2010 (netting); Sept. 13, 2010 (electrofishing)

**Dates of last survey:** June 29-July 1, 2009 (netting); Sept. 14, 2009 (electrofishing)

Managed Species	Other Species
Walleye	Black Bullhead
Yellow Perch	Common Carp
Smallmouth Bass	Northern Pike
	Bluegill
	Green Sunfish
	Hybrid Sunfish
	Black Crappie

## PHYSICAL DATA

**Surface area:** 1,817 acres

**Maximum depth:** 33 feet

**Volume:** No data

**Contour map available:** Yes

**OHWM elevation:** None set

**Outlet elevation:** None set

**Lake elevation observed during the survey:** Full

**Beneficial use classifications:** (4) warmwater permanent fish propagation, (7) immersion recreation, (8) limited-contact recreation and (9) fish and wildlife propagation and stock watering.

**Watershed area:** No data

**Mean depth:** 17 feet

**Shoreline length:** No data

**Date mapped:** 2002

**Date set:** NA

**Date set:** NA

## Introduction

Lake Sinai is a natural glacial lake located just northwest of the town of Sinai in west central Brookings County. It was named by county commissioners who felt the surrounding land resembled the land around Mount Sinai in the Holy Land. Heavy precipitation in the late 1980s doubled the size of the lake.

## Ownership of Lake and Adjacent Lakeshore Properties

Lake Sinai is listed as meandered public water in the State of South Dakota Listing of Meandered Lakes and the South Dakota Department of Game, Fish, and Parks (GFP) manages the fishery. GFP also owns and manages a Lake Access Area on the north side of the lake. The remainder of the shoreline is privately owned.

## Fishing Access

The North Lake Access Area has a double lane boat ramp with a dock, a large parking area, and a public toilet. Shore fishing access around the entire lake is limited.

## Field Observations of Water Quality and Aquatic Vegetation

Water clarity was excellent with a Secchi depth measurement of 3 m (118 in). Some suspended algae and beds of sago pondweed (*Potamogeton pectinatus*) were observed around the lake and there are still considerable areas of flooded trees and brush.

## BIOLOGICAL DATA

### Methods:

Lake Sinai was sampled on June 28-30, 2010 with five overnight gill-net sets and nine overnight trap-net sets. The trap nets are constructed with 19-mm-bar-mesh ( $\frac{3}{4}$  in) netting, 0.9 m high x 1.5 m wide (3 ft high x 5 ft wide) frames and 18.3 m (60 ft) long leads. The gill nets are 45.7 m long x 1.8 m deep (150 ft long x 6 ft deep) with one 7.6 m (25 ft) panel each of 13, 19, 25, 32, 38 and 51-mm-bar-mesh ( $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ , and 2 in) monofilament netting. Two hours of nighttime electrofishing were done on September 13, 2010 to evaluate walleye recruitment. Sampling sites are displayed in Figure 3. From the gill-net catch, otoliths were extracted and aged for five walleyes and yellow perch in each 10-mm increment in order to estimate growth rates and age structures of the populations.

### Results and Discussion:

## Gill Net Catch

Yellow perch and walleye were the most common species sampled in the gill nets this year and totaled 98% of the sample (Table 1). Smallmouth bass and northern pike were also sampled.

**Table 1.** Total catch from five overnight gill net sets at Lake Sinai, Brookings County, June 28-30, 2010.

Species	No.	%	CPUE <sup>1</sup>	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Yellow Perch	159	66.5	31.8	±11.6	52.7	81	26	101
Walleye	76	31.8	15.2	±3.8	14.2	28	4	84
Smallmouth Bass	3	1.3	0.6	±0.3	0.4	--	--	--
Northern Pike	1	0.4	0.2	±0.3	0.6	--	--	--

\*10 years (2000-2009)

<sup>1</sup> See Appendix A for definitions of CPUE, PSD, RSD-P, and mean Wr.

**Table 2.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Sinai June 28-30, 2010.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Yellow Perch	8.4	23.4	4.4	12.8	6.2	31.8	±11.6
Walleye	0.2	15.0	10.8	3.6	0.6	15.2	±3.8
Smallmouth Bass	0.2	0.4	0.2	0.2	--	0.6	±0.3
Northern Pike	--	0.2	--	--	0.2	0.2	±0.3

Length categories can be found in Appendix A.

## **Trap Net Catch**

Smallmouth bass (54.9%), and walleye (15.6%), were the most abundant species in the trap net sample (Table 3). Other species included common carp, yellow perch, bluegill, black crappie, green sunfish, and hybrid sunfish.

**Table 3.** Total catch from nine overnight trap net sets at Lake Sinai, Brookings County, June 28-30, 2010.

Species	No.	%	CPUE	80% C.I.	Mean CPUE*	PSD	RSD-P	Mean Wr
Smallmouth Bass	67	54.9	6.7	±3.1	1.8	21	7	103
Walleye	19	15.6	1.9	±1.3	1.9	32	5	88
Common Carp	16	13.1	1.6	±0.9	1.4	100	50	87
Yellow Perch	10	8.2	1.0	±0.6	8.2	70	10	99
Bluegill	4	3.3	0.4	±0.2	0.5	--	--	--
Black Crappie	4	3.3	0.4	±0.4	0.2	--	--	--
Green Sunfish	1	0.8	0.1	±0.1	0.2	--	--	--
Hybrid Sunfish	1	0.8	0.1	±0.1	0.1	--	--	--

\*8 years (2002-2009)

**Table 4.** Catch per unit effort by length category for various fish species captured with trap nets in Lake Sinai, June 28-30, 2010.

Species	Substock	Stock	S-Q	Q-P	P+	All sizes	80% C.I.
Smallmouth Bass	3.8	2.9	2.3	0.4	0.2	6.7	±3.1
Walleye	--	1.9	1.3	0.5	0.1	1.9	±1.3
Common Carp	--	1.6	--	0.8	0.8	1.6	±0.9
Yellow Perch	--	1.0	0.3	0.6	0.1	1.0	±0.6
Bluegill	--	0.4	0.1	0.2	0.1	0.4	±0.2
Black Crappie	--	0.4	0.3	0.1	--	0.4	±0.4
Green Sunfish	--	0.1	--	0.1	--	0.1	±0.1
Hybrid Sunfish*	--	--	--	--	--	0.1	±0.1

\*No length categories established. Length categories can be found in Appendix A.

## Walleye

**Management objective:** Maintain a walleye population with a gill-net CPUE of at least 15, a PSD range of 30-60, and a growth rate of 14 inches by age-3.

Walleye gill-net CPUE increased and surpassed the management objective and 10-year average this year (Table 5). Fish from the 2007 year class comprised the majority of the sample and have grown, on average, over 80 mm (3 in) since the 2009 survey (Table 6). The improvement seen in the overall population size structure (Figure 1) reflects this good annual growth. Condition (mean Wr) remains consistent for all lengths of walleye sampled (Table 5). The low numbers of age-1 and age-2 walleyes in the gill nets was expected based on the poor electrofishing catches of age-0 fish in 2008 and 2009 (Table 7).

**Table 5.** Walleye gill-net CPUE, PSD, RSD-P, and mean Wr in Lake Sinai, Brookings County, 2001-2010.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8	15.2	14.2
PSD	2	62	71	64	48	46	46	12	2	28	42
RSD-P	0	1	7	18	10	14	15	7	0	4	9
Mean Wr	98	98	84	84	87	86	89	82	85	84	88

\*10 years (2000-2009)

**Table 6.** Weighted mean length at capture (mm) for walleye captured in gill nets in Lake Sinai, Brookings County, 2003-2010. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9	10	11	12
2010 (75)	280 (1)	328 (10)	366 (45)	384 (15)	--	507 (2)	--	--	530 (1)	--	--	645 (1)
2009 (54)	218 (1)	283 (36)	338 (14)	369 (1)	398 (2)	--	--	--	--	--	--	--
2008 (57)	208 (14)	299 (36)	--	404 (4)	--	--	573 (2)	--	--	--	655 (1)	--
2007 (22)	221 (10)	--	345 (5)	--	467 (6)	--	567 (1)	--	--	--	--	--
2006 (37)	--	284 (20)	395 (4)	422 (5)	489 (2)	554 (2)	585 (1)	654 (3)	--	--	--	--
2005 (35)	194 (14)	314 (6)	364 (6)	409 (5)	440 (2)	661 (1)	--	687 (1)	--	--	--	--
2004 (24)	251 (4)	341 (5)	408 (8)	406 (3)	537 (1)	553 (1)	615 (1)	--	704 (1)	--	--	--
2003 (59)	215 (1)	339 (17)	422 (5)	502 (1)	455 (32)	558 (2)	606 (1)	--	--	--	--	--

The fall electrofishing survey found that the 2010 walleye fingerling stocking produced a large year class. The age-0 walleyes sampled were somewhat smaller and in poorer condition than fish collected in past years. No yearlings were collected from the weak 2009 year class.

**Table 7.** Age-0 and age-1 walleyes sampled during 2 hours of nighttime electrofishing on Lake Sinai, Brookings County, 2000-2010.

Year	Stocking	Age-0 CPH	80% C.I.	% stocked	Mean length (range; mm)	Wr	Age-1 CPH	80% C.I.	Mean length (range; mm)	Wr
2010	fingerling	211	160-262	100	154 (135-199)	80	0			
2009	none	29	21-37		185 (156-207)	96	2	1-3	242 (213-275)	90
2008	none	31	21-41		162 (135-185)	100	34	25-43	249 (205-290)	81
2007	none	113	63-139		161 (122-203)	95	17	11-23	282 (251-340)	79
2006	fingerling	291	199-393	96	175 (149-221)	85	0	--	--	--
2005	none	9	5-13		194 (163-212)	90	64	42-84	251 (223-294)	81
2004	fingerling	87	35-139	<sup>†</sup>	134 (110-160)	95	4	1-6	294 (270-314)	90
2003	none	19	12-26		209 (198-223)	101	22	18-26	317 (274-354)	87
2002	none	122	102-141		180 (147-206)	97	12	4-21	282 (200-315)	90
2001	none	59	36-81		169 (138-222)	105	6	3-9	324 (311-339)	97
2000	none	5	2-8		162 (152-174)	80	1	0-2	195	67

<sup>†</sup> Oxymerine killed immersed fingerlings so no marking of stocked fish was done.

## Yellow Perch

**Management objective:** Maintain a yellow perch population with a gill-net CPUE of at least 50 with a PSD range of 30-60.

Yellow perch gill-net CPUE decreased in 2010 and remains below the management objective (Table 8). In spite of this, several reports of good fishing in 2010 were noted. The perch sampled represented three consecutive year classes which indicates relatively consistent natural recruitment (Figure 2 and Table 9). Growth is faster than regional, statewide and large lakes means (Table 9) with fish reaching 20 cm (8 in) between age-2 and age-3. Yellow perch relative weight (Wr) is near the 10-year mean at just over 100. Older perch (ages 5 and 6) present in surveys from 2003-2006 have been absent in recent surveys. The reasons for this shift in age structure are not clear at this time.

**Table 8.** Yellow perch gill-net CPUE, PSD, RSD-P and mean Wr in Lake Sinai, Brookings County, 2001-2010.

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Mean*
CPUE	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8	31.8	52.7
PSD	94	70	24	82	85	76	73	52	90	81	71
RSD-P	10	26	1	0	28	23	2	19	0	26	12
Mean Wr	97	111	94	99	107	98	107	101	100	101	102

\*10 years (2000-2009)

**Table 9.** Weighted mean length at capture (mm) for yellow perch captured in gill nets in Lake Sinai, Brookings County, 2003-2010. Note: sampling was conducted at approximately the same time during each year allowing comparisons among years to monitor growth trends. Sample size in parentheses.

Year	1	2	3	4	5	6	7	8	9
2010 (159)	107 (42)	206 (76)	259 (41)	--	--	--	--	--	--
2009 (208)	--	208 (188)	251 (17)	276 (3)	--	--	--	--	--
2008 (67)	132 (40)	220 (13)	255 (14)	--	--	--	--	--	--
2007 (44)	146 (12)	221 (29)	247 (3)	--	--	--	--	--	--
2006 (169)	143 (24)	211 (83)	224 (20)	266 (5)	268 (35)	294 (2)	--	--	--
2005 (246)	128 (27)	204 (75)	225 (15)	248 (125)	287 (2)	281 (2)	--	--	--
2004 (261)	127 (39)	194 (34)	226 (182)	247 (6)	--	--	--	--	--
2003 (59)	--	186 (253)	208 (43)	243 (7)	235 (3)	262 (3)	--	--	--

## All Species

Only nine species were sampled in Lake Sinai in 2010. Trap net CPUE for smallmouth bass was the highest ever. CPUE for other species was within previously observed ranges (Table 10). Rough fish and bullheads are not a problem at this time.

**Table 10.** Gill-net (GN) and trap-net (TN) CPUE for all fish species sampled in Lake Sinai, Brookings County, 2001-2010.

Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
COC (GN)	--	5.2	3.0	4.8	1.2	1.2	--	0.2	0.8	--
COC (TN)	*	2.0	5.2	1.7	0.9	0.1	1.0	0.3	0.3	1.6
BLB (GN)	39.8	49.5	32.3	5.3	0.2	0.2	0.5	--	--	--
BLB (TN)	*	634.0	45.5	9.9	3.9	2.5	1.8	0.3	0.6	--
NOP (GN)	1.7	0.5	1.5	0.3	0.7	0.8	--	0.2	--	0.2
NOP (TN)	*	--	0.1	0.1	0.4	--	0.3	--	0.1	--
GSF (GN)	--	--	--	--	--	--	--	--	--	--
GSF (TN)	*	1.1	--	--	0.1	--	0.3	0.2	0.1	0.1
HYB (GN)	--	--	--	--	--	--	--	--	--	--
HYB (TN)	*	0.4	0.1	0.1	--	--	0.1	--	--	0.1
BLG (GN)	--	--	--	--	--	--	--	--	--	--
BLG (TN)	*	0.4	0.2	0.2	0.2	0.8	1.9	0.4	--	0.4
SMB (GN)	--	--	--	--	0.3	0.2	1.0	1.0	1.2	0.6
SMB (TN)	*	--	--	0.2	0.9	2.0	5.2	4.6	1.2	6.7
BLC (GN)	--	--	--	--	--	0.2	--	--	--	--
BLC (TN)	*	--	--	--	--	0.9	0.2	--	0.4	0.4
YEP (GN)	40.2	127.7	77.3	65.0	40.8	28.0	11.0	13.6	41.8	31.8
YEP (TN)	*	42.8	6.6	2.6	6.4	1.8	1.5	2.0	2.2	1.0
WAE (GN)	32.7	30.7	14.8	6.0	5.8	6.2	5.5	11.4	10.8	15.2
WAE (TN)	*	0.5	1.4	0.8	1.1	1.8	5.6	3.2	0.8	1.9

\*Trap nets were not used from 1998-2001

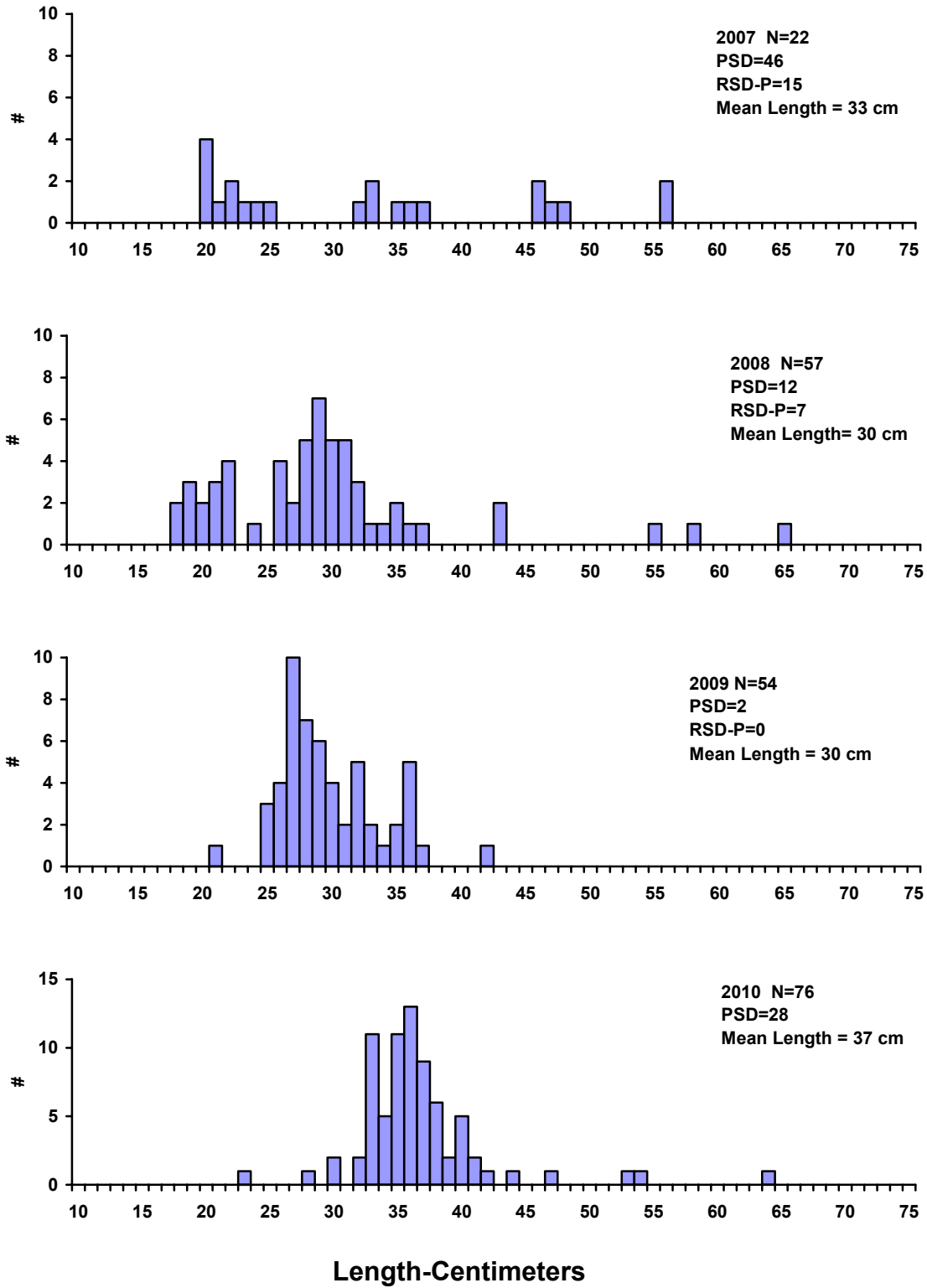
COC (Common Carp), BLB (Black Bullhead), NOP (Northern Pike), GSF (Green Sunfish), HYB (Hybrid Sunfish), BLG (Bluegill), SMB (Smallmouth Bass), BLC (Black Crappie), YEP (Yellow Perch), WAE (Walleye)

**Table 11.** Stocking record for Lake Sinai, Brookings County, 1991-2010.

<b>Year</b>	<b>Number</b>	<b>Species</b>	<b>Size</b>
1991	32,115	Yellow Perch	Fingerling
1992	30,399	Yellow Perch	Fingerling
	22,480	Walleye	Lrg. Fingerling
1993	19,644	Walleye	Lrg. Fingerling
1994	30,950	Bluegill	Fingerling
	19,268	Walleye	Lrg. Fingerling
1995	32,000	Bluegill	Fingerling
	60,000	Largemouth Bass	Fingerling
1996	1,994	Bluegill	Fingerling
	192,540	Walleye	Fingerling
1998	2,400,000	Walleye	Fry
1999	11,689	Yellow Perch	Adult
2002	65	Smallmouth Bass	Adult
2003	57,470	Smallmouth Bass	Fingerling
2004	170,200	Walleye	Fingerling
	13,440	Smallmouth Bass	Fingerling
2005	58,340	Smallmouth Bass	Fingerling
2006	173,060	Walleye	Fingerling
2010	172,480	Walleye	Fingerling

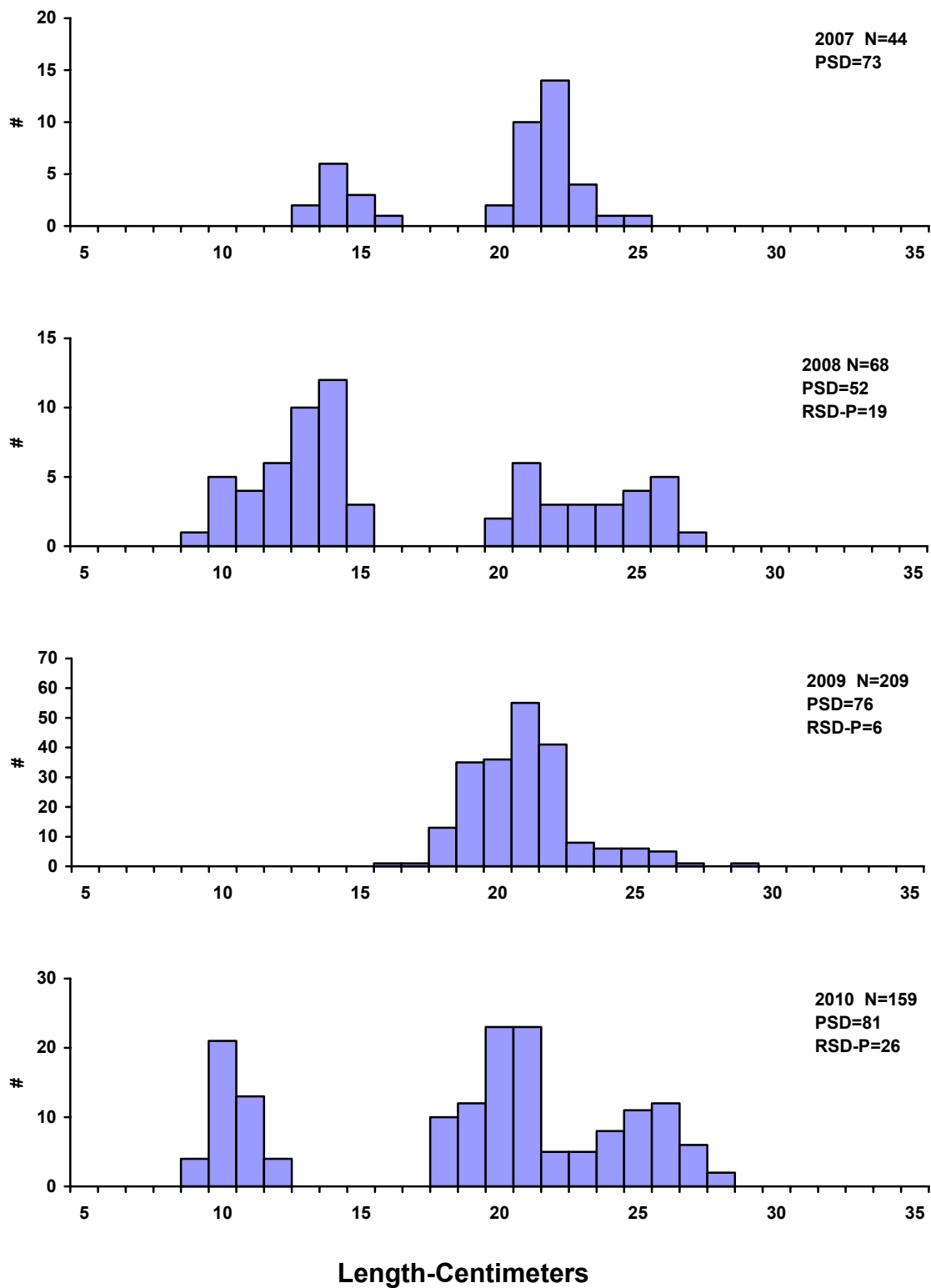
### **MANAGEMENT RECOMMENDATIONS**

1. Monitor the Lake Sinai fishery by conducting annual summer netting surveys to assess the fish population and fall electrofishing surveys to assess walleye recruitment.
2. Achieve the walleye management objective stocking fry or fingerlings into voids of natural reproduction as determined by fall electrofishing surveys.
3. Consider stocking fry, fingerling, or adult yellow perch if natural reproduction fails to maintain population density at objective levels.

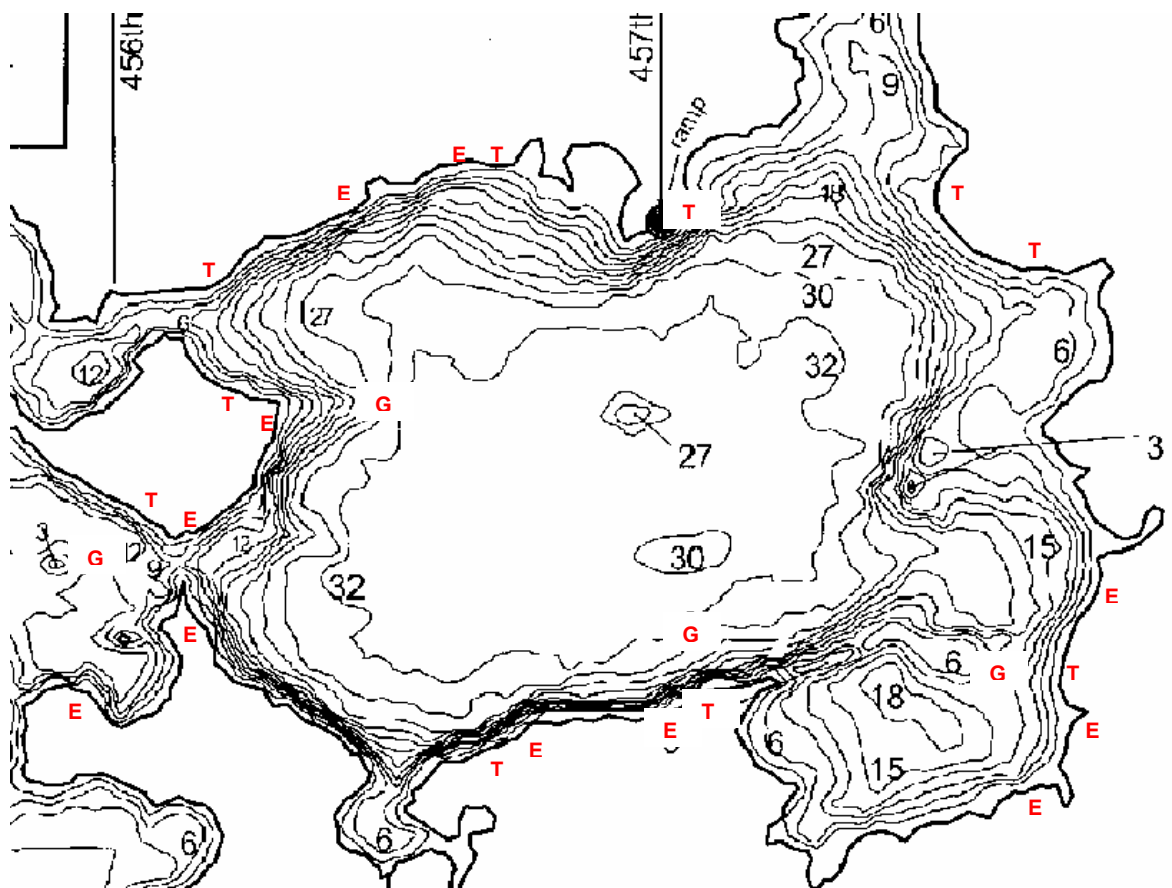


**Figure 1.** Length frequency histograms for walleyes sampled with gill nets in Lake Sinai, Brookings County, 2007-2010.





**Figure 2.** Length frequency histograms for yellow perch sampled with gill nets in Lake Sinai, Brookings County, 2007-2010.



**Legend**

Gill Net Sites: **G**

Trap Net Sites: **T**

Electrofishing Sites: **E**

**Figure 3.** Sampling locations on Lake Sinai, Brookings County, 2010.

**Appendix A.** A brief explanation of catch per unit effort (CPUE), proportional stock density (PSD), relative stock density (RSD) and relative weight (Wr).

**Catch Per Unit Effort (CPUE)** is the catch of animals in numbers or in weight taken by a defined period of effort. Can refer to trap-net nights of effort, gill-net nights of effort, catch per hour of electrofishing, etc.

**Proportional Stock Density (PSD)** is calculated by the following formula:

$$\text{PSD} = \frac{\text{Number of fish} > \text{quality length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

**Relative Stock Density (RSD-P)** is calculated by the following formula:

$$\text{RSD-P} = \frac{\text{Number of fish} > \text{preferred length}}{\text{Number of fish} \geq \text{stock length}} \times 100$$

PSD and RSD-P are unitless and usually calculated to the nearest whole digit.

Size categories for selected species found in Region 3 lake surveys, in centimeters.

Species	Stock	Quality	Preferred	Memorable	Trophy
Walleye	25 (10)	38 (15)	51 (20)	63 (25)	76 (30)
Yellow perch	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Black crappie	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
White crappie	13 (5)	20 (8)	25 (10)	30 (12)	38 (15)
Bluegill	8 (3)	15 (6)	20 (8)	25 (10)	30 (12)
Largemouth bass	20 (8)	30 (12)	38 (15)	51 (20)	63 (25)
Smallmouth bass	18 (7)	28 (11)	35 (14)	43 (17)	51 (20)
Northern pike	35 (14)	53 (21)	71 (28)	86 (34)	112 (44)
Channel catfish	28 (11)	41 (16)	61 (24)	71 (28)	91 (36)
Black bullhead	15 (6)	23 (9)	30 (12)	38 (15)	46 (18)
Common carp	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)
Bigmouth buffalo	28 (11)	41 (16)	53 (21)	66 (26)	84 (33)

For most fish, 30-60 or 40-70 are typical objective ranges for “balanced” populations. Values less than the objective range indicate a population dominated by small fish while values greater than the objective range indicate a population comprised mainly of large fish.

**Relative weight (Wr)** is a condition index that quantifies fish condition (i.e., how much does a fish weigh for its length). A Wr range of 90-100 is a typical objective for most fish species. When mean Wr values are well below 100 for a size group, problems may exist in food and feeding relationships. When mean Wr values are well above 100 for a size group, fish may not be making the best use of available prey.